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Integrating Home Economics Education with STEAM: Thematic Review

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Abstract

Home Economics (HE) education provides a unique platform for connecting everyday life skills with academic and technological disciplines, fostering students' ability to apply knowledge in practical, real-world contexts. This interdisciplinary foundation supports the integration of HE and STEAM (Science, Technology, Engineering, Arts, and Mathematics) education in pedagogically meaningful ways, as both emphasise experiential learning, critical thinking, and creative problem-solving.

This review explores how HE and STEAM are defined and conceptualised in integrated educational practices. Two research questions were addressed in this study: 1) How interdisciplinary learning is supported through pedagogical approaches that blend scientific, technological, artistic, and life-based skills? 2) What are the key benefits of this integration?

The paper analyses research from the last ten years (2015–2025) to highlight the potential of integrating HE with STEAM to support meaningful, life-oriented learning across diverse educational settings.

Our analysis reveals that HE has continually adapted to societal change, evolving into an inherently interdisciplinary field that aligns with STEAM principles. The findings highlight strong conceptual and pedagogical connections between HE and STEAM, particularly in fostering problem-solving skills, creativity, and the real-world application of knowledge. These insights suggest that integrating the two fields can enhance future-oriented education by supporting innovative teaching practices and strengthening learners' life skills. Although the articles analysed are not focused on STEAM content from a similar perspective, the analysis still shows that the findings highlight strong conceptual and pedagogical connections between HE and STEAM, particularly in fostering problem-solving skills, creativity, and the real-world application of knowledge.

KEYWORDS: **STEAM EDUCATION, HE, HOME ECONOMICS, INTEGRATION, PEDAGOGICAL PRACTICES**

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Introduction

HE (Home Economics) has a complex and multifaceted history as a knowledge and educational practice field. Emerging in the late nineteenth and early twentieth centuries, it was initially conceived to formalise and elevate the domestic skills traditionally associated with women, such as cooking, nutrition, textiles, and household management (Andreasen & Rasmussen, 2022). Although from its very beginnings, HE pioneer Ellen Richards integrated everyday practical content with science, elucidating connections to both physics and chemistry (Soudan et al., 2021), as a subject, HE is often narrowly defined by its focus on the transmission of specific domestic skills. Over time, HE has evolved, both in its content and its societal role, reflecting broader changes in gender roles, educational philosophy, and societal needs (McCloat & Caraher, 2019). Also, the interdisciplinary links between HE and various scientific fields are increasingly recognised and more clearly articulated. Notably, the field's inherently interdisciplinary nature has positioned HE as a precursor and partner to contemporary STEAM (Science, Technology, Engineering, Arts, and Mathematics) education.

STEAM and HE share a focus on practical application, critical thinking, and preparing individuals to manage everyday challenges in personal, family, and community life. Moreover, both fields value hands-on, experiential learning, making HE a powerful and relevant context for enacting STEAM education, especially when aiming to engage learners in meaningful, life-based inquiry (Paas et al., 2025).

This manuscript explores the intersection of HE and STEAM Education by reviewing recent studies on how these two fields are defined, conceptualised, and integrated in educational practice. The focus is on understanding how this integration supports interdisciplinary learning, particularly through pedagogical approaches that blend scientific, technological, artistic, and practical life skills. Additionally, the review examines the benefits, challenges, and barriers encountered in merging HE with STEAM, highlighting implications for curriculum development and teaching strategies in diverse educational settings.

The literature review is essential because it provides a structured and evidence-based foundation for understanding how HE and STEAM have been connected and interpreted across the last decade. Using a thematic review allowed us to synthesise diverse research, identify recurring patterns, and reveal meaningful interdisciplinary links that are not visible in single studies. This ensures that the paper builds on the most current knowledge and offers readers a reliable, well-organised overview of developments shaping both fields. For readers—researchers, teachers, policymakers, and curriculum developers—it provides a structured overview of how STEAM and HE have been conceptualised, connected, and implemented in recent scholarship. By mapping the state of the field, the review equips the readership with an evidence-based understanding that can inform future research, guide pedagogical decisions, and support the effective integration and implementation of STEAM and HE across educational contexts.

Definition of STEM

The acronym "STEM" is defined according to four disciplines (Science, Technology, Engineering, and Mathematics), but understanding what STEM means in practice is more nuanced and debated. The STEM acronym originated in the early 1990s in the United States, specifically within the National Science Foundation (NSF). STEM emerged largely from economic and

geopolitical necessity, with the dual goals of advancing scientific literacy and fostering technological innovation. The National Research Council's committee (2014) found evidence suggesting that combining the STEM fields can enhance student learning motivation. Kelley and Knowles (2016) note that integrating science, technology, engineering, and mathematics within education systems often aligns with broader policy goals to sustain innovation, workforce readiness, and international competitiveness. This alignment reflects a shift in educational priorities toward addressing urgent global issues through a skills-based, interdisciplinary approach. Sam Mejias and his colleagues (Mejias et al., 2021) emphasised the development of the acronym, likely contributing to efforts to unify the four disciplines into one content domain. STEM education is a multidisciplinary approach that integrates science, technology, engineering, and mathematics, promotes essential 21st-century skills, and encompasses formal and informal learning across all levels of education (Hebebci & Usta, 2022). Although STEM initiatives might have included design elements, it became increasingly clear that a deeper, more intentional integration of artistic and human-centred perspectives was necessary. This shift marked the evolution toward STEAM, where the arts are not merely added for enrichment, but play a critical role in shaping the purpose, impact, and meaning of STEM-based work (DOSE, 2023).

The Shift From STEM to STEAM

STEM (Science, Technology, Engineering, Mathematics) focuses on technical knowledge and problem-solving, but many real-world challenges also require creative thinking, empathy, and cultural understanding. Adding the Arts (the "A" in STEAM) acknowledges that innovation is not just technical—it is also emotional, aesthetic, and social (Sanz-Camarero et al., 2023).

Incorporating the arts into STEM helps to broaden the appeal of these traditionally technical subjects (Colucci-Gray et al., 2019). Students who may feel disconnected from or intimidated by abstract scientific or mathematical content often find the arts' creative, expressive, and human-centred aspects more accessible (Danielson et al., 2022). When artistic disciplines—such as visual design, music, storytelling, or drama—are used to explore STEM concepts, learners can engage with content through different modes of learning and systems thinking (Grace et al., 2021). This diversifies how students access and experience knowledge, offering alternative ways to participate and succeed.

Today's professional landscape increasingly values 21st-century skills that combine technical expertise with creativity, innovation, and communication. Fields such as architecture, product design, urban development, environmental sustainability, and interactive media require professionals who can think critically, solve real-life problems systematically, and design functional and user-centred solutions (Razi & Zhou, 2022). These roles demand the precision of science and engineering and the creativity and empathy rooted in the arts. STEAM education acknowledges and prepares students for this reality by promoting interdisciplinary learning that mirrors how challenges are approached in the real world (Bertrand & Namukasa, 2020). In this way, STEAM better aligns with the skill sets needed in 21st-century careers than STEM, which tends to emphasise technical knowledge in isolation.

Previous studies (Sanz-Camarero et al., 2023) suggest that integrated STEAM education offers a more comprehensive and well-rounded approach than the earlier STEM model. STEAM also fosters creativity and innovation by combining the complementary ways of thinking in the arts and sciences (Colucci-Gray et al., 2019).

Opening the Acronym: The Key Disciplines

Understanding what each STEAM subject brings helps clarify how they work independently and interdependently. According to Sanders (2009), STE(A)M is an ambiguous acronym, particularly highlighting the confusion around what "T" and "E" actually mean and how they are interpreted differently by various educators and professionals. He highlights that different groups, like technology educators, see Engineering as naturally aligned with their field. However, career and technical education (CTE) professionals also claim to be in engineering because many programs involve applied engineering skills (e.g., robotics, automotive systems, construction). This overlap leads to no clear consensus or definition of Engineering or Technology in a STE(A)M education context.

In the following, we will clarify what lies behind the STEAM acronym and what is essentially meant by these subjects.

Science in STEAM

Science refers to the structured natural and physical world exploration through careful observation, hands-on experiments, and logical analysis. It encourages students to ask meaningful questions, investigate phenomena, and use evidence to conclude. Through subjects like biology, chemistry, physics, and earth science, learners build critical thinking and inquiry skills that help them understand how the world works (McGregor, 2019).

Technology in STEAM

The "T" is often misunderstood as only computing or digital technologies. In reality, the technology context is broader—it includes design, systems, processes, tools, and more, created to solve problems and meet human needs. Education includes digital devices, coding and understanding how technology affects individuals, society, and the environment. It emphasises design thinking, innovation, and the responsible use of tools in everyday life (Sivaraj et al., 2019)

Engineering in STEAM

Engineering is the application of scientific and mathematical principles to design, build, and improve structures, systems, and processes. It involves problem-solving, embracing creativity (Connor et al., 2015), and the iterative design process—identifying problems, imagining solutions, prototyping, testing, and refining (Wahyuningsih et al., 2020). Engineering teaches learners how to apply knowledge to practical challenges.

Arts in STEAM

In the STEAM context, the "A" can include humanities (visual arts, film, theatre), physical arts (sculpture, musical performance), and social sciences (history, philosophy, politics) (McGregor, 2019; Yakman, 2017). Integrating the arts into STEM strengthens students' abilities to communicate clearly and think critically while encouraging them to see issues from a broader, global viewpoint (Bertrand & Namukasa, 2020).

Math in STEAM

Mathematics is the study of numbers, patterns, shapes, and relationships. It provides tools for reasoning, calculating, measuring, and modelling the world. Math supports logical thinking and problem-solving, and it is foundational to understanding patterns and structures across all other STEAM disciplines (Belbase et al., 2021).

STEAM Education Concept

STEAM is not just a temporary trend but a growing field in curriculum development and educational research with lasting significance (McGregor, 2019; Perales & Aróstegui, 2024). Furthermore, STEAM education can be implemented in schools and higher education to help transform the educational system and address the demands of the 21st century and beyond (Belbase et al., 2021).

On one hand, STEAM holds great potential by promoting diverse ways of understanding and creating more equitable learning opportunities. On the other hand, its application in theory, teaching methods, and practice can sometimes be unclear or used inconsistently, leading to mixed outcomes (Mejias et al., 2021)

STEAM education does not just teach these subjects (Science, Technology, Engineering, Arts, and Mathematics) side by side—it integrates them to help learners see connections and apply their knowledge in meaningful, real-world contexts (Connor et al., 2015). By combining science, technology, engineering, arts, and math creatively and practically, STEAM education helps develop 21st-century skills (work in teams, communicate clearly, think critically and solve problems, be creative and adaptable) (Haesen, 2019; Li, 2024).

STEAM education is about more than interdisciplinary teaching—it is a philosophical shift. It challenges the fragmentation of knowledge by encouraging learners to see connections between fields, question assumptions, and engage with complexity. In doing so, the STEAM movement positions education as a transformative force, not only to develop skills for the workforce but to cultivate deeper understanding, critical thinking life skills, and sustainability-minded citizens (Colucci-Gray et al., 2019).

The Emergence of HE: Social and Educational Contexts

This section explores the beginnings of HE education, its social and educational significance, and its enduring and evolving connections to STEAM.

The development of HE as a formal field of study was deeply intertwined with the social, economic, and political transformations of the nineteenth and early twentieth centuries. In the United States, researcher Ellen Richards (1842–1911) is widely known for applying scientific methods (e.g., chemistry applied to food and sanitation) to domestic tasks, helping turn everyday household work into a recognised discipline of “domestic science” and later HE (Philippy, 2021, p. 379). For example, her movement framed HE as “the science of consumption” and connected household environments with broader social conditions and economic notions of rational consumption (Philippy, 2021, p. 392). While, in Denmark, the period from 1890 to 1940 was particularly significant for the institutionalisation of HE education (Andreasen & Rasmussen, 2022). Prior to this, women’s education was largely informal, with domestic skills passed down through generations without the recognition or status afforded to male-dominated fields such as agriculture or trade.

The rise of HE was propelled by several factors. The transition to democratic forms of government, the expansion of the welfare state, and the increasing importance of health and nutrition in public policy all contributed to the recognition of domestic knowledge as essential for societal well-being (Hernes, 1987; Rogers, 2006). In Nordic countries, for example, in Denmark and Finland, the establishment of schools of HE provided new educational

opportunities for women, who had previously been excluded from most forms of secondary and higher education (Andreasen & Rasmussen, 2022; Broberg et al., 2021). Similarly, in Estonia, the first HE schools can be regarded as the first schools providing vocational education for girls (Taar, 2015).

Similarly, in Ireland, HE (initially termed "domestic subjects") became part of the primary and postprimary curriculum in the nineteenth century, with the explicit aim of enhancing the quality of life for families and equipping young women with practical skills for everyday life (McCloat & Caraher, 2019). The subject evolved from cookery and needlework to a broader curriculum encompassing nutrition, health, and home management, reflecting changing societal expectations and the growing recognition of the importance of these skills for both individual and public health (McCloat & Caraher, 2019). In the same way, the value of the subject has changed in many countries. As an example, in Latvia, HE has evolved from a narrow, practical discipline into one that supports holistic student development and awareness of quality of life (Dislere et al., 2020).

In non-Western contexts, scholarship shows the global reach of HE. For example, in Japan, the subject of *kateika kyōiku* (HE Education) emerged in the Meiji period as part of the ideology of "good wife, wise mother" (*ryōsai kenbo*) and later post-WWII reforms made HE compulsory for both girls and boys, thereby repositioning it in a democratic, gender-equal frame (Field, 2016, p. 3). In Slovenia, more recent research emphasises how HE education has adapted to cultural and social change, and how its curricula reflect societal shifts (Erjavšek, 2021).

The Multidisciplinary Nature of HE: Foundations for STEAM

An interdisciplinary approach is central to HE as a field of study and educational philosophy (McGregor, 2019). As the International Federation for HE (IFHE) notes, HE education aims to address real-world, practical problems through an interdisciplinary and transdisciplinary approach, equipping students with the knowledge, skills, attitudes, and values necessary for sustainable and healthy living (IFHE, 2008; Magee et al., 2010). This already sets the tone for the education to be interdisciplinary.

With an early background strongly based on natural science, the connections between HE and STEAM are historical and ongoing. In the early twentieth century, the scientific study of nutrition, hygiene, and household management brought the methods and content of science and mathematics into the domestic sphere. For example, teaching nutrition required an understanding of biology and chemistry, while budgeting and resource management drew on mathematical skills (Andreasen & Rasmussen, 2022; McCloat & Caraher, 2019).

Yet the curriculum for HE education has traditionally included topics such as nutrition (science), food preparation and preservation (technology), textiles and clothing construction (engineering and arts), household budgeting (mathematics), and interior design (arts and technology) (Erjavšek, 2021; IFHE, 2008), in several countries, contemporary curricula have both deepened and widened the connections between HE education and STEAM. HE education now often includes modules on food science, environmental sustainability, consumer technology, and design thinking, areas that directly intersect with STEAM disciplines (Erjavšek, 2021). In Slovenia, for instance, the HE curriculum encompasses healthy lifestyle, nutrition, textiles, economics, and sustainable development, all of which require the integration of scientific, technological, and mathematical knowledge (Erjavšek, 2021).

Moreover, the pedagogical approaches of HE, such as project-based learning, critical thinking, and reflective practice, all mirror those advocated in STEAM education. Both fields emphasise the application of knowledge to solve practical, real-world problems, fostering creativity, innovation, and lifelong learning (McCloat & Caraher, 2019).

Method

We applied thematic review to analyse published articles by identifying, organising, and interpreting recurring themes across sources. It helped to make sense of complex information and highlight meaningful connections between disciplines like HE and STEAM. Thematic review included six steps (Naeem et al., 2023): (1) defining the purpose and research questions; (2) planning the literature search; (3) searching and collecting sources; (4) organising the literature; (5) evaluating the literature; (6) interpreting the results. Among the databases available to the authors, EBSCO, Web of Science, JSTOR, Scopus, and Google Scholar were selected for this review's literature search because of their strong academic credibility and broad disciplinary coverage”

These databases offered a balanced combination of depth, relevance, and efficiency for identifying key sources aligned with the review’s objectives. These searches aimed to identify all relevant national and international published works in full-text format. To ensure accessibility and consistency, the search was limited to English-language journals that could be accessed through the selected databases.

The main terms included in the search were: ‘STEAM/STEM in home economics’, ‘family and consumer sciences (FCS) in STEAM’, ‘food and nutrition integration with STEAM/STEM’, ‘home science education’, ‘science of cooking´, ‘digital tools in home economics’, ‘home economics literacy’, ´home economics and technologies´, ‘HE and ICT (Information and Communication Technology)’, ‘Food in science education´, ‘Food in STEAM’, ‘Math in home economics´, ‘Art in home economics /cooking’, technology in home economics´, ‘AI in home economics´. The paper analyses research from the last ten years (2015–2025) to ensure that the analysis reflects the most up-to-date research and educational developments.

Figure 1 shows the criteria for thematic analysis. An initial search across academic databases returned a total of 65 papers. A clear set of inclusion and exclusion criteria was applied to ensure the relevance and coherence of the review. Articles were included only if they directly referenced HE or its recognised equivalents, such as Family and Consumer Sciences, Food Technology, or similar terms. These terms had to appear explicitly in the text to ensure that the article substantively engaged with the discipline. Articles that were duplicate entries, inaccessible, or that only mentioned HE indirectly, without engaging with the core subject matter, were excluded.

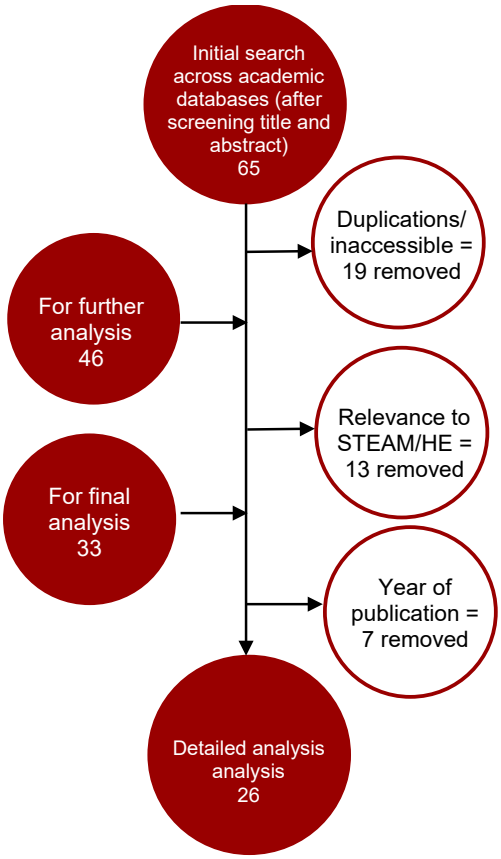

Figure 1 Thematic review criteria

The remaining papers were systematically categorised based on year of publication and their relevance to the STEAM framework and HE Education. Following this, to classify each article within STEAM, a coding system was developed whereby articles with a primary focus on science were coded as 'S'; those related to technology were coded as 'T'; articles discussing aspects of engineering were marked as 'E'; those involving the arts were coded as 'A'; and finally, articles addressing mathematics were coded as 'M'. Each article was reviewed individually to determine which domain or combination of domains it addressed, and the appropriate STEAM codes were applied.

This categorisation enabled the identification of disciplinary emphases and intersections within the literature. Therefore, from the initial 46 eligible articles, 26 were selected for in-depth analysis based on the strength and clarity of their relevance to both HE and the STEAM components. Table 1 illustrates the screening and selection process.

Table 1 Connections between STEAM and HE. Articles listed

Nr	Article	Areas of STEAM relevant to the article					Key Themes that emerge per article						
		S	T	E	A	M	Inter-disciplinary Learning	Problem solving & Critical Thinking	Creativity & Design Thinking	Real-World Application & Life Skills	Collaboration & Team Work	Technology Integration	Innovation & Future Skills
1	Arroz, M. D. (2024).		✓		✓		✓			✓		✓	
2	Baiden, P., Essel, H. B., Vlachopoulos, D., Tachie Menson, A., & Essuman, M. A. (2021).		✓		✓			✓	✓		✓	✓	
3	Belbase, S., Mainali, B. R., Kasemsukpipat, W., Tairab, H., Gochoo, M., & Jarrah, A. (2021).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
4	Dauvarte, L. (2015).		✓					✓	✓	✓		✓	✓
5	Dislere, V., Pridane, A., Vronska, N., & Lice-Zikmane, I. (2020).		✓				✓	✓	✓	✓		✓	✓
6	Ejinkeonye, U. B., & Usoroh, C. I. (2016).		✓				✓	✓		✓		✓	
7	Erjavšek, M., Lovšin Kozina, F., & Kostanjevec, S. (2020).	✓	✓				✓	✓		✓			
8	Fooladi, E. C., Tuomisto, M., & Haapaniemi, J. (2023).	✓					✓	✓	✓	✓			
9	Gard, M., & Enright, E. (2016).	✓	✓									✓	
10	Jamaluddin, R., Mohd Shah, N. H., Mohd Puad, M. H., Mohd Sufian Kang, E. K., & Jusoh, R. (2023).	✓	✓	✓		✓		✓	✓				✓
11	Lim, M., Abell, A., Szocs, C., & Biswas, D. (2024).					✓	✓	✓					
12	McGregor, S. L. T. (2019).	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
13	Mejias, S., Thompson, N., Sedas, R. M., Rosin, M., Soep, E., Peppler, K., Roche, J., Wong, J., Hurley, M., Bell, P., & Bevan, B. (2021).	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓
14	Merrill, C. A., & Lawver, R. G. (2019).	✓	✓	✓		✓		✓		✓			
15	Morris, B. J., Zentall, S. R., Murray, G. W., & Owens, W. (2021).	✓	✓	✓		✓	✓			✓	✓		

Nr	Article	Areas of STEAM relevant to the article					Key Themes that emerge per article						
		S	T	E	A	M	Inter-disciplinary Learning	Problem solving & Critical Thinking	Creativity & Design Thinking	Real-World Application & Life Skills	Collaboration & Team Work	Technology Integration	Innovation & Future Skills
16	Oluwagbemileke, F. B. (2024).		✓					✓	✓		✓	✓	
17	Pendergast, D., Deagon, J., Du Plessis, A., McManus, S., & Blayney, B. (2022).	✓	✓				✓			✓			✓
18	Pridāne, A. (2017).	✓	✓		✓	✓			✓	✓		✓	✓
19	Saratapan, N., Pitiporntapin, S., & Hines, L. M. (2019).	✓	✓	✓		✓		✓	✓			✓	✓
20	Saroukh, S. A. K. (2024).		✓	✓	✓		✓	✓	✓	✓		✓	
21	Sundqvist, K., Korhonen, J., & Eklund, G. (2021).		✓				✓	✓				✓	
22	Surgenor, D., McMahon-Beattie, U. S. M., Burns, A., & Hollywood, L. E. (2016).	✓	✓		✓			✓	✓			✓	
23	Taar, J., & Palojoki, P. (2022).		✓				✓	✓			✓		✓
24	Umeh-Idika, A. S. (2023).		✓					✓				✓	✓
25	Vartiainen, H., & Tedre, M. (2023).		✓		✓			✓	✓	✓		✓	✓
26	Veeber, E., Taar, J., Paas, K., & Lind, E. (2017).		✓		✓		✓	✓	✓	✓		✓	

Main Findings: Practices of Integrating STEAM and HE Education

According to the thematic analysis, STEAM aligns naturally with HE, where practical, creative, and ethical knowledge intersects (e.g., sustainability, food systems, family life).

Science

Firstly, delving into practices from a health perspective, including food and nutrition. HE activities in this strand are anchored in scientific principles, especially biology, chemistry, and health sciences. For example, students engage with the biochemistry of nutrients, study metabolic processes, and learn about the effects of different diets on physiology, supporting a strong linkage to biology and health sciences (McGregor, 2019; Wesley, 2015). Food preservation methods and food safety lessons introduce applied chemistry and microbiology. Students investigate chemical reactions, spoilage mechanisms, pasteurisation, cooking (chemical and physical changes), and the influence of temperature and pH on microorganisms (Apple et al., 2016; Deaton et al., 2018). Scientific experimentation may include hypothesis-driven recipe development, comparative studies of preservation techniques, or analysing the causes of food-borne health issues (Deaton et al., 2018; Turkki, 2015).

Secondly, from an arts perspective, including textiles and craftsmanship. Students explore the chemistry and physics of fibres, distinguishing between properties of natural vs. synthetic materials, moisture retention, colourfastness, and allergenic qualities (Dislere, 2012; McGregor, 2019). Experiments with dyeing, fabric strength, and environmental biodegradability of materials reinforce scientific thinking and the application of laboratory methods to everyday products (Dislere, 2012; Park et al., 2016).

Thirdly, from a sustainability perspective, including responsible living and resource management. Environmental science concepts pervade this strand, including ecological footprints, energy use, sustainable agriculture, recycling, and human development (Colucci-Gray et al., 2019; Turkki, 2015). Students may explore household impacts on the environment (waste, water, energy) and investigate scientific solutions for sustainability at the family and community level (McGregor, 2019).

Technology

In nutrition, diet and health activities, there is extensive use of kitchen technology, from basic cooking appliances to advanced food processing equipment, and ICT tools like nutritional analysis applications and databases for dietary planning. Professional and domestic kitchens now commonly integrate digital temperature probes, programmable ovens, and online meal-planning tools. This digital shift connects HE with the “T” in STEAM (Bush & Cook, 2019; Dislere, 2012; Park et al., 2016). The development and critique of new technologies for healthy eating or for food safety monitoring (e.g., using applications to record calorie intake or track allergens) also demonstrates the evolving intersection of this strand with the world of technology (Wesley, 2015).

While textiles and craft are also technologically advanced fields. Modern classrooms may use CAD programs for designing patterns or apparel, digital embroidery, and advanced sewing machines (Dislere, 2012). There is also increasing interest in “smart textiles,” merging electronics with fabric to create wearable technology (Dislere, 2012). ICT resources allow students to research, model, and prototype ideas efficiently and with a broader creative reach (Dislere, 2012).

Similarly, home automation, ICT for budget and resource tracking, apps for food waste auditing, and energy-saving appliances bring technology to daily sustainability efforts (Bush & Cook, 2019; Dislere, 2012). Families might use digital calendars, spending trackers, or innovation in household tools for resource management and sustainability (Dislere, 2012).

Engineering

The engineering design process is evident in areas such as health and nutrition. Recipe development and food product innovation (including packaging, preservation, and preparation), as well as improvements to kitchen workflow or layout, follow stages such as defining a problem, ideating solutions, prototyping, testing, and refinement (Henriksen et al., 2017). For instance, students can use engineering thinking to create a new recipe that accounts for dietary restrictions, design experiments to minimise waste, or improve efficiency and safety in a kitchen setting (Apple et al., 2016; Park et al., 2016; Randel, 2014). Such approaches not only strengthen understanding of engineering but also encourage iterative, problem-based learning, central to STEAM education (Land, 2013).

Similarly in textile and craft lessons, students employ the engineering design process in garment construction and pattern drafting (Apple et al., 2016; Randel, 2014). This might involve ideating, developing, testing, and refining bags for strength or comfort, or engineering ergonomic design solutions for particular consumer needs (Apple et al., 2016; Saratapan et al., 2019). Engineering principles may also be applied in product testing, such as ensuring a hand-crafted bag can hold a certain weight through iterative redesign (Saratapan et al., 2019).

Moreover, applied engineering is witnessed in optimising home layouts for resource efficiency, developing upcycling systems, and designing sustainable solutions for water, waste, and energy management (Dislere, 2012; Yakman, 2017). Systems thinking, understanding household operations as interrelated flows (water, energy, materials) mirrors engineering and systems design thinking in STEAM (McGregor, 2019).

Arts

HE draws from the arts to elevate food staging, plating, and garnishing, fostering creativity and attention to detail (Randel, 2014; Turgeson, 2014). Lessons often explore cultural food traditions, blending historical and artistic perspectives on culinary practices (Dislere et al., 2020). The artistic aspects of food preparation can also be tied to emotional and cultural expression, exploring cuisine as a mode of creative and social communication (Taylor, 2016).

Textiles, craft, and design are traditionally artistic domains. Students develop aesthetic sensibilities through fashion design sketches, costume construction, crafting techniques, and by drawing inspiration from cultural textile traditions (Aquino, 2017; Harris & de Bruin, 2017). Lessons often require artistic creativity in the use of colour, form, pattern, and expression, blending the functional with the beautiful (Randel, 2014).

Artistic expression in sustainability may appear as creative upcycling, interior design with recycled materials, eco-friendly decoration, and crafts that reflect cultural heritage and environmental values (McGregor, 2019). Communication of sustainability principles often uses visual and performing arts (posters, videos, exhibitions) (Perales & Aróstegui, 2024).

Mathematics

Quantitative skills are foundational in areas such as food, diet and health, students use math to scale recipes, measure ingredients, calculate nutritional values (like macronutrient ratios), determine portion sizes, analyse food costs, and stick to meal budgets (Deaton et al., 2018). Math is also essential in experimental cooking (ratios, percentages, data collection), food processing (yield percentages, conversions), and even in evaluating the economic impact or efficiency of dietary choices (Wesley, 2015).

Likewise, mathematical skills are required in textiles and craft for measurements, pattern drafting, geometric calculations (e.g., area for fabric requirements), symmetry, ratio, and scaling (Deaton et al., 2018). Budgeting for materials, optimising cost efficiency, and estimating labour time are also core mathematical activities, strengthening numeracy and practical problem-solving (Dislere, 2012; Wesley, 2015).

While, quantitative analysis is used for budgeting, investment calculations, and assessing the economic and environmental impact of family decisions (Rabalais, 2014; Turkki, 2015). For example, calculating the carbon footprint of transportation choices, measuring energy use, or evaluating cost savings from sustainable practices supports strong mathematical skills (Wesley, 2015).

In addition, the analysis of the reviewed articles revealed several key themes that consistently underpin the integration of HE education within STEAM areas. Central to these is interdisciplinary learning, which facilitates connections across diverse subject areas, reflecting the holistic nature of HE. Problem solving and critical thinking emerged as core competencies, with many studies highlighting the value of equipping students to navigate complex, real-world challenges. Creativity and design thinking were also prominent, often linked to hands-on, project-based tasks that mirror authentic life scenarios. Closely related is the emphasis on real-world application and life skills, reinforcing the subject's practical roots in everyday living. Additionally, collaboration and teamwork featured strongly, underscoring the importance of social learning and communication. The integration of technology was identified as both a tool and a context for learning, enabling modern and relevant teaching practices. Finally, a future-oriented focus on innovation and future skills highlights the role of HE in preparing students for dynamic societal and workforce needs. Together, these themes affirm the subject's relevance and adaptability in contemporary education.

Limitations, Challenges and Future Directions

A thematic review was employed to enhance the trustworthiness of our findings through a transparent six-step process by Naeem et al. (2023). Each step, from the formulation of research questions to interpretation of results was guided by clear criteria to maintain consistency and reliability. We critically evaluated sources to ensure their academic quality and relevance. This structured approach enhanced the credibility of connections identified between HE and STEAM disciplines.

Nonetheless, one limitation of our thematic review is the dependence on available literature, as some pertinent articles were inaccessible. Additionally, the thematic reduction of complex and context dependent data into seven overarching themes introduced a risk of oversimplification. To mitigate the potential loss of depth and nuance, the review was deliberately restricted to literature published within the past decade.

Despite its rich history and clear relevance to STEAM, HE has often struggled for recognition and legitimacy within educational systems. In many countries, the subject has been marginalised, its complexity reduced to 'cooking and sewing', and its status diminished relative to more narrowly defined academic disciplines (Ma & Pendergast, 2011). This marginalisation has implications not only for the profession but also for society's capacity to address complex, interdisciplinary challenges related to health, sustainability, and well-being.

Nevertheless, there is growing recognition of the need to revitalise and reimagine HE education. As societies confront issues such as food security, environmental sustainability, and public health, the integrative, applied knowledge fostered by HE is increasingly valued. The field's alignment with STEAM provides a powerful framework for its renewal, enabling it to contribute to the development of critical, creative, and socially responsible citizens.

Conclusion

The literature review synthesises a decade of diverse research to provide a clear, evidence-based understanding of how HE and STEAM have been conceptualised, connected and implemented, offering readers a reliable foundation that informs future research, guides pedagogical decisions and supports effective integration across educational contexts.

The origins of HE education are rooted in the social, economic, and political transformations of the nineteenth and twentieth centuries. Initially conceived to formalise and elevate domestic knowledge, the field has evolved into a multidisciplinary domain that integrates science, technology, engineering, the arts, and mathematics. Its history reflects the challenges and opportunities of gendered education, the struggle for professional recognition, and the enduring relevance of practical, life-oriented learning.

The connections between HE and STEAM are profound and enduring. Both fields share a commitment to interdisciplinary learning, problem-solving, and the application of knowledge to real-world challenges. As educational systems seek to prepare students for the complexities of contemporary life, the integration of HE and STEAM offers a promising path forward, one that honours the field's rich history while embracing its potential for innovation and social impact.

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